

of some hidden physical causes whose exact mode of operation is not known. We all know, however, that variations are *facts* of nature, and it is not difficult to see that they are the necessary consequences of the varying number, amount, proportion, and manner of action, of the natural forces acting on different portions of living matter. Now, in making variations the starting-point, the theory of natural selection may justly be considered to be "incomplete," even as our knowledge of electricity is incomplete because we do not know the real nature of the thing, as astronomy is incomplete because we do not know for certain how, for instance, the solar system was formed; but in so doing the theory cannot be "essentially faulty" or "fundamentally erroneous." It is illogical, not to say childish, to think a theory to be erroneous because it cannot render a definite explanation of some unquestionable facts of nature on which it is based and with which it starts. To prove the theory of natural selection to be erroneous, it must be shown that it is never competent to originate species. If it ever falls, it will fall quite *irrespectively* of its avowed inability to give definite explanations as to the exact mode of occurrence of variations. S. B. MITRA

19, Keppel Street, Russell Square, London, August 17

Red Sunsets and Volcanic Eruptions

PROF. S. NEWCOMB'S article on the above subject in *NATURE* of August 12 (p. 340) induces me to send you a brief account of the atmospheric phenomena that I observed in Palermo during and after the recent eruption of Mount Etna.

This volcano is 133 kilometres distant from Palermo, but the transparency of the air here is so great that it is almost always visible from this Observatory.

At dawn on May 21 the smoke from the eruption appeared as a great mass of black vapour, rising from the southern side of the volcano. At 11 a.m. it had formed into rosy balls of vapour, or cumuli. With the theodolite I measured the angular height— $2^{\circ} 21'$, which gives 8 kilometres of linear altitude. On May 24 the smoke had the characteristic form of a pine-tree, and a greater height, but at 4 p.m. the upper edge of it was not well defined, and I obtained (approximately) the altitude as 14 kilometres.

Since May 22 these vapours from Etna have spread over the eastern, and more recently over the entire, horizon of Palermo. In the early morning of June 3 the fog was so dense that the sun was invisible, and the towers of the Matrice, 200 metres distant, were only indistinctly visible, which in Palermo is quite extraordinary. From May 29 to June 3 Italy has been invaded from south to north with mist, which was probably also derived from Etna.

Cinders from the volcano have fallen over Eastern and Southern Sicily, and over Calabria, as well as in Palermo, where, in the dust gathered on the terraces of the Observatory on May 27, I detected with the microscope some minute crystalline laminae of labradorite, which mineral is characteristic of the ejections of Etna.

The sun rising from the sea behind these mists has been purple-red and then reddish-yellow; at a height of about 30° it was neutral gray, but never green or blue. In Nicolosi, too, on the side of the volcano, these colours of the sun have not been observed. The light of the red sun was so faint that it was possible to look at it without inconvenience.

No corona (like "Bishop's ring") was observed around the sun or moon. Spectroscopic observations of the red sun gave only the ordinary atmospheric absorptions, perhaps somewhat intensified.

In the latter part of May and during the month of June the red after-glows appeared almost daily, and were stronger than before or since, but they were not so brilliant and prolonged as in 1831 and 1883-84, and their colour was not properly rosy, but an impure reddish-yellow.

I believe that the red sun was caused by the finest cinders from the volcano, suspended in the air, as the like phenomenon is produced by the dust of the Höheraich in Northern Europe, of the Sirocco in Sicily, and of the Kamsin in Africa. The blue sun (observed after the eruptions of Ferdinandea and of Krakatō) has not appeared, and the after-glows were not strongly brilliant, because the vapours ejected from Etna were not so enormously abundant as those ejected from Ferdinandea and Krakatō, which are marine volcanoes more directly communicating with the water of the sea.

The observation by M. Janssen, mentioned in *NATURE* of

July 29 (p. 299), of a blood-red coloration of light traversing dust, gives a strong confirmation to the preceding explanation of the red sun. A. RICCO

Palermo Observatory, August 17

P.S.—Since July Bishop's ring has not been visible in Palermo.

The Bright Clouds and the Aurora

ON the morning of the 11th inst. I had an opportunity of watching the curious cirrus-like clouds as daylight came on. The display was striking, though not such a bright one as on several former occasions. It first appeared about 2.30 a.m., when there were very faint indications of the clouds; it was some minutes before I noticed that they were the same brilliant kind as has appeared so often this summer. Their apparent upper border being irregular, it was uncertain whether they in any part reached the limit to which the sun could shine upon them, or whether the apparent border was altogether the actual edge of the cloud-sheet; however, it rose higher as the sun approached the horizon, but this might be owing to the circumstance that the motion of the clouds was, as usual, from an easterly direction. At 3.33½ a.m. they were visible as far as α Andromedæ, though they were very faint west of γ . By 3.45½ a.m. they reached down to within 5° of α Aquilæ, and were rather plain there, and by this time the sheet covered most of the sky, though none of it remained visible very low down in the east. It was no longer bright in any part. At 3.55½ they reached down to within 4° of α Aquilæ, and were plainest about there, but growing fainter. I was still uncertain whether the sheet extended beyond the western apparent border, that being simply the limit of sunshine, or whether the sheet ended there; but probably the former was now the case. At 4 a.m. they were scarcely noticeable, and by 4.11 they had disappeared altogether. By this time a faint pink glow had appeared in the east.

The question is, Was the disappearance of the clouds due to their having evaporated, and ceased to exist, or to their light being overpowered by the brightness of the sky? It appeared to me that the latter was the case. It will be well if further observers can confirm this supposition or otherwise; if correct, they cannot be considered clouds at all in the ordinary sense, the sky being beautifully clear and blue after they had ceased to be visible. I could not say at any time that the clouds were not perfectly transparent to the stars. The circumstance that they have never been described as having been seen by day seems confirmatory of the above supposition.

With respect to Prof. Smyth's remark about the spectrum (p. 311) I do not gather whether he considers that the auroral line noticed by him belonged to all to the clouds or entirely to the aurora; but I think that there can be no doubt that the latter was really the case. He does not seem to have detected any aurora at the spot where the clouds were seen, but doubtless it was there, although overpowered by their brightness. As it is so evident that these clouds were illuminated by the sun (this being confirmed by their varied colours depending on their altitude, as described by Prof. Smyth), we cannot expect their spectrum to be otherwise than solar and atmospheric. I looked at them with a miniature spectroscope on the evening of July 12, as well as on the morning of the 11th inst., but on neither occasion was the spectrum bright enough for me to perceive much. I could not see any lines, bright or dark, but the spectrum faded very abruptly in passing from green to orange, which no doubt was owing to the atmospheric bands near D, especially the "low sun band."

On July 27 I saw the aurora mentioned by Prof. Smyth at Gilsland, in Cumberland, and it was a particularly magnificent one there, especially about 10.25 p.m., at which time a part of it was lilac—a very unusual colour. The bright clouds were also visible that night, but chiefly before the aurora appeared and after it vanished; there appears no reason to suppose there is any connection between the two phenomena.

As regards the dark space beneath the auroral arch, has the theory mentioned by Prof. Smyth ever been proved, that there is any true darkness there, and that it is not merely the effect of contrast with the aurora? My impression is that it must be at least mainly the effect of contrast, though perhaps not entirely, and the idea is confirmed by a similar darkness sometimes appearing by contrast with the brilliant clouds, when no

aurora is present; the stars shine quite bright in this dark sky above them.

Prof. Smyth considers that the night after the aurora of the 27th the twilight extended over the region "aurora-blackened" the evening before. Would not this be owing to the brightness of the aurora preventing the twilight from being seen so high then simply by contrast? The fact that the dark sky was luminous in the spectroscope seems to bear out this.

I do not understand Prof. Smyth's suggestion why these clouds should never be seen in winter, for any night in the year there is a time when the sun is at the same distance below the horizon as it is when the bright clouds are well seen.

Sunderland, August 18

T. W. BACKHOUSE

Cloud Effect

A VERY unusual cloud effect was noticed here on the 18th inst. at 7.45 a.m. The whole sky, especially to the east or south-east, was at that time covered with a widespread field of mackerel cloud. This field was cut from north to south with a strongly defined cleft or narrow line showing the blue sky beneath. It was like a crack in the cloudy tissue, and formed a perfect arch, whose greatest altitude was not many degrees above the sun's apparent place. It lasted nearly half an hour. There was little wind at the time, only a slow motion from the north, but a change took place shortly after, when it veered to the south-west.

E. BROWN

Further Barton, Cirencester, August 20

The Crag Deposits on the North Downs

To students of Tertiary geology, the interest of Mr. Clement Reid's verification of Prof. Prestwich's judgment of many years ago as to the Pliocene age of certain outlying deposits at Lenham is so great that I must crave permission for space for a line or two with reference to other similarly situated deposits on the North Downs, which have been described as belonging to an horizon "so nowhere between the Chalk and the moon." The deposits to which I refer were described by Prof. Prestwich in the *Q. J. G. S.*, vol. xiv., and of his paper Mr. Whitaker made free use in preparing the account of these outliers in vol. iv. of the "Memoirs of the Geological Survey" (pp. 336-42). The idea has been for some time growing up in my own mind, with reference to these unfossiliferous outliers, that some of them will have to be recognised as remnants of the once more widely extended Upper Bagshot Sands. This conclusion is at present based mainly on three facts: (1) the literal application of Prof. Prestwich's description of their lithological character to portions of those beds; (2) the occurrence of "similar beds on the Chalk Downs on the opposite side of the Channel, between Calais and Boulogne"; (3) the superposition of "analogous strata" on the top of Cassell Hill in French Flanders upon the *Calcaire grossier* series, the equivalent of our Middle Bagshot (so-called Brackleshams) Beds. I hope to deal with this more at length during the next session of the Geological Society, and only draw attention now to the suggestion which I threw out several years ago (*Proceedings of the Geological Association*, vol. viii. p. 170) for reasons assigned, that the oldest plateau-gravels of the London Basin are probably of Pliocene age. This may possibly have escaped Mr. C. Reid's notice.

A. IRVING

Wellington College, Berks, August 17

Actinotrocha on the British Coasts

IN answer to Mr. Cunningham's letter on the distribution of Tornaria and Actinotrocha, I may state that I took Actinotrocha in the tow-net at the mouth of this bay on July 31. I believe I have found it more than once before on the west coast during the last few years, but, not having my note-books with me, I cannot say definitely where and when. If I am not mistaken, *Phoronis* was found by Dr. Strehli Wright in the Firth of Forth, and is therefore known as a British animal.

Loch Ranza, Arran, August 21

W. A. HERDMAN

GEORGE BUSK, F.R.S.

A SINGLE-MINDED, true-hearted man, a warm friend, and an able and accomplished naturalist, has just passed away from the midst of his family, his friends, and his fellow-workers.

George Busk was the second son of Mr. Robert Busk, of St. Petersburg. He was born in 1807, and at an early age gave promise of those tastes and of that aptitude for research which, developing with his years, gained for him the high position which he was destined to hold among the scientific workers of his time.

After completing his medical education he was appointed surgeon to the seamen's hospital-ship *Dreadnought*, a post which he continued to hold for about twenty-five years. It is these twenty-five years which constitute the strictly professional period of his life, and which gained for him a place among the most distinguished members of his profession as an able, clear-sighted, and enlightened surgeon.

In 1856 he resigned his appointment to the *Dreadnought*, and at the same time decided on retiring from professional practice and on devoting himself to scientific work.

Having now leisure for the cultivation of those studies which were always dear to him, he threw himself warmly into biological work. An excellent and cautious observer, it was chiefly to researches on the structure of the lower members of the organic world that he now devoted himself, and scarcely a month passed without the periodical literature of biology receiving from his labours the record of some new and interesting fact.

About this time he became one of the editors of the *Microscopical Journal*, and the numerous communications which appeared from his pen in the pages of that periodical contributed largely to its popularity and success.

There were few departments of biological science which Busk did not enrich by his researches, and we now find following one another in rapid succession a long series of papers containing the results of his studies among the lower groups of the animal and vegetable kingdoms. He was a skilful microscopist, an acute and conscientious interpreter of the optical expressions of organic form presented by the microscope to the observer, and his contributions to the transactions of our leading scientific societies and to various natural history journals have advanced our knowledge of some of the simple unicellular plants, of the Infusoria, the Hydroida, the lower Vermes, and above all of the Polyzoa, to an extent which those who have worked in the same fields can fully appreciate.

In 1856 appeared his article "Polyzoa" in the English Cyclopædia. In this admirable article we have an exhaustive account of the structure of the Polyzoa, while it contains the first satisfactory attempt at a scientific arrangement of the group, and proposes for the first time the employment of certain systematic characters which are now universally accepted as offering the only legitimate bases of a philosophical classification.

Soon after this he undertook the labour of drawing up an illustrated descriptive catalogue of the Polyzoa contained in the collection of the British Museum, and brought to bear on the descriptions and systematic arrangement of the species those principles whose soundness he had already established. There was thus placed in the hands of the student a work of great value, with which no investigator of the group can afford to dispense.

On the return of H.M.S. *Rattlesnake* from its explorations in the Australian seas under Capt. Owen Stanley, the collections of Polyzoa and Hydroids made during the voyage were placed in Mr. Busk's hands for examination and description. His report on the new species thus obtained is published in the narrative of the voyage, and forms an important addition to our knowledge of these animals.

Among the facts of anatomical interest which have been successfully worked out by Busk in the organisation of the Polyzoa, his demonstration of the structure of the *avicularia* and *vibracula* deserves special mention. He has given by far the best account which had been hitherto